M.R.O. 1—77,000—3-6-31.

(1) Number of pages 48

(2) Date of repair 17/8/44

(3) Initials of the Referencer

MADRAS RECORD OFFICE.

Government of Madras.

Public works DEPARTMENT.

G.O. No. 1449 Press / Mis.

184

Dated 12 6 1872.

Not to be folded or roughly handled

Proceedings of the Madras Government, Public Works Department,
12th June 1872.

No. 184.

Under date the 11th June 1872, *No.* 1,449.

CIVIL WORKS, No. 16.

THE Government have already expresssd to Mr. Robertson, through the Government of India, their appreciation of his valuable Report on the Harbours of the Madras Presidency, and now proceed to pass the necessary orders thereon.

2. The only two harbours at which important works are recommended are Mangalore and Cochin, both well known to the Chief Engineer, and the Government fully concur in the recommendations made by him, in the memorandum herewith appended, for carrying into effect Mr. Robertson's views with some slight variation.

3. A sum of Rupees 7,000 from Port Funds is accordingly placed at the disposal of the Superintending Engineer of the 7th Division for collection of materials during the monsoon, and construction of a training groyne at the Goorpoor gap immediately after it; and he will submit complete estimates of the total probable cost of closing the gap in time to admit of the work being done some months before the monsoon of 1873, so that the deposit between the gap and the harbour mouth shall be acted on by the current of the Goorpoor river, and the danger of monsoon floods caused by the same diminished as much as possible.

4. As stated in Colonel Walker's memorandum and detailed in papers accompanying G. O., No. 1,125, of 2nd May, all Mr. Robertson's suggestions as to protective works at Cochin, Vypeen, and Cruz Milagre, have already been acted upon by the Superintending Engineer of the 7th Division. Lieutenant-Colonel Farewell will in due course proceed to supply the detailed drawings and estimates for the works intended by Mr. Robertson nearly to double the depth of water over Cochin bar. The Government are unable just now to carry out Colonel Walker's suggestion of instituting a Cochin and West Coast Canal Range, but order the following arrangements to be made, as the best means available for strengthening the hands of the Palghaut and Mangalore Range Officers, namely, the transfer of Supervisor Vyapoory Pillay, now under orders for Coondapoor Range, to the Palghaut Range, of which he can take charge, freeing Assistant Engineer Grime for the Cochin work, and the promotion of Overseer DeMello to rank of Supervisor vicè Cowley dismissed, and his posting to the Coondapoor Range now held by Assistant Engineer Pringle in addition to his own.

5. Of the minor works of improvement suggested by Mr. Robertson for Cannanore and Beypore, the Superintending Engineer of the 7th Division will be good enough to submit plans and estimates.

6. The attention of the Master Attendant at Madras (Administrative Department) is called to the requirements of the port of Calicut, to which he will be so good as to attend, reporting when they shall have been met.

7. The subject of inland water communication along the West Coast will be disposed of separately at a later date, in connection with a scheme now before Government involving its development by private enterprize.

8. Looking at the character of the bay into which the Paumben passage opens, as well as the tortuous nature of the channel, Mr. Robertson reports that it would be out of all question to attempt to make the pass fit for large ships; or indeed deeper than 12 feet at low water of spring tides. The attention of the

Superintending Engineer of the 8th Division is called to Mr. Robertson's remark that the season was being lost for blasting operations for want of a regular supply of powder; and Mr. Dalrymple is requested to report on the character and cost of the lights stated to be required at Point Calimere and the Crocodile Rock.

9. The remarks in page 53 on one if not two safe and commodious anchorages, close to the locality of the new ship canal between India and Ceylon, proposed by Sir James Elphinstone, are full of interest.

10. The Superintending Engineer of the 6th Division will have plans and estimates prepared for lengthening the Pier at Negapatam 150 feet beyond monsoon low water line, for deepening and fixing the south side of the outlet, and for dredging the harbour, as recommended at pages 55 and 56 of Mr. Robertson's Report. It is observed that he approves generally of the Report of the Committee of 1860.

11. The Government have had frequent remonstrances addressed to them on their neglect of Cocanada, which is acquiring considerable importance as a place of trade. Mr. Robertson's Report is discouraging, but it is useful as furnishing a reply to the frequent memorials addressed to Government, and as preventing waste of money on the various projects which have been submitted. Copy of this part of his Report will therefore be communicated to the memorialists.

12. The Master Attendant of Madras will carry into effect Mr. Robertson's recommendations, that the whole length of channel from Cocanada to the entrance of Coringa river should be buoyed off; and he will report on the cost of the dredging operations to be undertaken at Coringa and Cocanada bays, of a light boat off Hope Island, and of the cost (with maintenance) of a steam tug for the Master Attendant at Cocanada. The Superintending Engineer of the 1st Division will report as to the agency necessary for conducting the proposed survey of the neighbourhood of Hope Island and experiments as to currents; and the Cocanada Harbour works, suggested in page 73, will also be planned and estimated for.

13. The subject of a breakwater at Madras, on which the Chief Engineer has reported against the delay considered expedient by Mr. Robertson, has been reported on to the Government of India.

14. It is observed that Mr. Robertson makes no recommendations for works at Alleppy, Narakal, Quilon, Tuticorin, and Porto-Novo, either because none are practicable, or, if practicable, advisable, on account of disproportionate expense.

(True Extract.)

(Signed) R. F. OAKES, Captain, R.E.,
Acting Joint Secretary to Government.

To the Superintending Engineers, 1st, 4th, 5th, 6th, 7th, and 8th Divisions.
,, Marine Department.
,, Controller of Public Works Accounts.
,, Master Attendant (Administrative Department).
,, Chamber of Commerce, Madras.
,, Do. Cocanada, with Extract.

Exd. S. T. Augustin.

MEMORANDUM BY THE CHIEF ENGINEER.

Mangalore Harbour.—It is a satisfaction to me to find that Mr. Robertson coincides in the opinion which I formed and expressed many years ago as to the necessity of closing the Goorpoor gap, and I quite concur in his advice that the gap should be directly acted on by damming its mouth, instead of indirectly, as in 1856, by damming the river, and so restricting the tidal basin that the gap must have closed of itself. I have to point out, however, that the destruction of the dam of 1856 was not caused by any action of tide, but by a river fresh which came down on the night of the 30th April, the commencement of the work having been delayed too late for want of early sanction.

2. I do not agree with Mr. Robertson in one point, for I do consider it desirable to close the gap at once. Nothing could be better than his *modus operandi*, whether for the closing of the gap itself by a sand-bag dam or for gradual action on the shoals between it and the harbour mouth by a training groyne of slight material. I would commence with the second certainly as he recommends, but when the scouring action, which must inevitably ensue, has gone on for a sufficient time, I would proceed to the execution of the dam. It will be much easier to clear out the shoal between the two river mouths now than in 1858, as comparison of the two surveys will show that its length is reduced since that date by fully 1,000 yards, and the soundings show a great improvement also, and the danger of flooding above is proportionally decreased.

3. Reliable estimates cannot be made of the probable cost of this work till after the monsoon, when the river floods are over and the gap has settled down to its dry weather form. I would place the sum of Rupees 7,000, transferred from the Mangalore Pier, at the Superintending Engineer's disposal for collection of materials during the monsoon to the value of Rupees 5,000, namely, sand-bags, piles, bundles, and brush-wood, etc., and by September the Executive Engineer might commence the training groyne under instructions from Lieutenant-Colonel Farewell, who has lately been watching the progress and results of a similar work at Cochin, and will be able to tell him precisely how to act. By November, estimates for closing the gap may have been sent in and sanctioned, when I should hope that the Superintending Engineer would be able to find time to visit Mangalore, and have the work carried out under his own eye.

4. Lieutenant-Colonel Farewell will then also be able to prepare detailed estimates of the cost of carrying out Mr. Robertson's suggestions for fixing the north of the harbour mouth, when the propriety of acting on them may be considered. For my part, I do not think anything of the kind should be done. I believe that, so long as there are two outlets to the sea from the backwater which joins the Naitrawutty and Goorpoor rivers and tidal basin, so long will the outlet of the southern and much larger river tend gradually northward, either till it meets the northern gap (which is quite stationary), or, which I consider most probable and highly desirable, till a greater than usual monsoon flood bursts out a passage for itself near Oolaul, where the mouth was at the commencement of the century, when there is reason to believe that the harbour bar was much better than it has been ever since. Indeed, it is well known to have deteriorated the further north the outlet was.

5. Hence the primary necessity for closing the Goorpoor gap, when three natural forces, namely, the respective river streams acting from within and the tide water from without, will, by a natural dynamical law, fix the single outlet in a position which will be the natural resultant of the three forces, and so to be preferred to any artificial outlet against which one or other of them would be working detrimentally. Not but that there might possibly be a certain amount of shifting of the natural outlet according to the varying monsoon floods of the rivers, but works to control that fluctuation would be much less costly to construct and maintain than those which would be required to keep in its place an outlet not the resultant of natural forces.

6. It does not appear practicable to spare Mr. Pringle the services of an Assistant, as proposed by Mr. Robertson, but arrangements have been made for relieving him of the Coondapoor Range, which Lieutenant-Colonel Farewell once thought of doubling up with the Mangalore Range, an idea which he has now abandoned much to my satisfaction, and the work of Mangalore Range will not be so heavy this year as to prevent Mr. Pringle devoting much of his time to harbour observations and work.

7. Cochin Harbour.—All Mr. Robertson's suggestions, as to the closing of the Cruz Milagre Gap and defence of the Cochin and Vypeen Coasts, have already been acted upon by Lieutenant-Colonel Farewell, to an extent of which he has reported the success and probable cost of work in continuation, and G. O., No. 1,125, of 2nd May 1872, which embodies my views, will show how thoroughly I approve of all that Mr. Robertson has recommended on the subject. That of increasing the depth of water over the bar is one with which I have not hitherto had to deal at Cochin, my attention having been confined to protective works. I have perused Mr. Robertson's remarks on the treatment of the bar with great interest, and, though hardly prepared to endorse his sanguine anticipation that, by the construction of training groynes of from 2,000 to 3,000 feet in length and by dredging, the present depth of 11 feet over the bar may be increased to 20 or 21 feet, I cannot in the least gainsay the general accuracy of his conclusion that "to strengthen the current and confine it till it arrives into deeper water, where the waves act with less effect on the bottom, is evidently the way to treat the harbour at Cochin."

8. I propose accordingly to call on the Superintending Engineer to prepare detailed drawings and estimates of two groynes, composed of rubble cores faced with concrete blocks, as I conceive that the use of both materials would lead to speed and economy of construction. Special assistance must be afforded him as well as funds for supervision of works already in hand, surveys and measurements of those to be undertaken, and preliminary investigation as to the cost of quarrying and moving rubble on a large scale, and of making concrete blocks, say, of 8 cubic yards (9 feet × $4\frac{1}{2}$ × $4\frac{1}{2}$) or half the dimensions of those used at Kurrachee. The same officer would hereafter be available for investigating the details of the improvements to canal communication along the West Coast, on which Mr. Robertson makes remarks of great practical interest. In fact I would create at once a Cochin and West Coast Canal Range, and provide for its cost by savings which I have no doubt the Controller will be able to indicate.

9. I am not of opinion that the erection of a bund across the backwater at Palliport is necessary or even desirable. It would hamper existing traffic, and tend to accumulation of deposits, troublesome and costly to remove; and the tidal basin of Cochin is already so enormous that the proposed extension would not, by its additional action, benefit the bar to an appreciable extent.

10. MADRAS BREAKWATER.—Mr. Robertson has decided that a breakwater is the best expedient for obtaining shelter for shipping at Madras, but takes advantage of some loose reasoning of the Harbour Committee (with which he evidently does not himself agree) to demand further information as to the littoral currents, and quantity of sand in motion along the coast. I think that he has put aside the information already supplied without due cause; and that, had he argued upon it with the same perspicacity with which he confuted the notion of sand accumulating round piles of stone on the Armeghon shoal (see page 68), he would not have come to the conclusion that there was any danger of silting up behind the breakwater.

11. In point of fact he only comes to such conclusion on a false hypothesis of the Committee, not concurred in by himself, and opposed to the true conclusion to be arrived at from existing information as to currents and sand. This is to the effect on the one hand that at from 600 to 1,800 yards from the shore there are littoral surface currents, not exceeding one mile an hour in maximum velocity, and on the other that there is no current at bed of sea at seven fathoms, (beyond which it is proposed to construct the breakwater), and no loose movable sand beyond the six-fathom line. There is no reason whatever to doubt the accuracy of these observations; and it only remains to draw correct conclusions from them.

12. As Mr. Robertson says, there are two agents at work to move the sand, the surf acting perpendicularly to the shore and the littoral currents parallel to it; the former agitating the sand and causing it to be held in suspension, the latter moving it north or south according to the season. But there is not the slightest ground for imagining that the littoral currents beyond the six-fathom line are at all impregnated with sand; it is all dropped within that line. Hence there can be none to deposit beyond 7 fathoms, where the breakwater is to be. Hence also the fallacy of the Committee's reasoning against Mr. Fraser's project; their objection would be invalid against groynes reaching out beyond six-fathom water. Mr. Robertson has hit the true objection to his scheme, which is otherwise the best proposed after the breakwater project.

13. I deprecate, therefore, any postponement of the breakwater scheme on the score of further information being necessary as to currents and sand deposits. It is now matured sufficiently to be determined for or against on the simple grounds of its value compared to its cost. The Master Attendant could easily procure further information as to currents if necessary. As to the extent to which sand is moved, nothing but actual construction of a groyne out beyond six-fathom line would settle the question experimentally. But I maintain that for all practical purposes we have information enough; it has only to be argued upon as correctly as has been done by Mr. Robertson in the matter of a proposed breakwater on the Armeghon shoal. The argument in page 61 of the Report, that the removal of one motive agent, the surf, would cause the other agent to drop sand behind

the breakwater is fallacious, because it assumes that the littoral current will have sand in suspension; whereas it can have none outside six-fathom line in any case; still less behind the breakwater, where the agent, which agitates the sand and makes it movable, will be annihilated. Hence the Committee had reason to conclude, on the one hand, that the foreshore will be rendered steeper, but none, on the other hand, for apprehending its extension, as the littoral current freed from action of surf should tend to keep the foreshore clean swept of loose sand.

(Signed) G. W. WALKER, Colonel, R.E.,

8th May 1872. *Chief Engineer.*

Exd. S. T. Augustin.

Civil Works
7

No. 1449.
1449

Mem. to
depositor

Under Sec.

The Government have already expressed to Mr. Robertson, through the Government of India, their appreciation of his valuable Report on the Harbours of the Madras Presidency; and now proceed to pass the necessary orders thereon.

The only two harbours at which important works are recommended are Mangalore and Cochin,

[initials]

both well known to the Officiating Chief Engineer, and the Government fully concur in the recommendations made by him, in the Memorandum herewith appended, for carrying into effect Mr. Robertson's views with some slight variation.

A sum of Rs. 7000 from Port Funds is accordingly placed at the disposal of the Supg Engineer of the 7th Division for collection of materials during the monsoon, and construction of a training groyne at the Gaorpoor gap immediately

after it - And he will sub-
mit complete estimates of
the total probable cost
of closing the gap in
time to admit of the
work being done some
months before the
Monsoon of 1873, so that
the deposit between the
gap and the Harbour
Mouth shall ~~[illegible]~~ be
acted on by the current
of the Jaorpoor River,
and the danger of Monsoon
floods caused by the
same diminished, as
much as possible.

As stated in Col.
Walker's Memorandum
and detailed in papers

accompanying G. O.
No. 1125 of 2d May, all
Mr. Robertson's suggestions
as to protective works
at Cochin, Vypeen and
Cruz Milagre, have
already been acted
upon by the Supg: Engi-
neer of the 7th Division.
Lt.Col. Farewell will in
due course proceed
to supply the detailed
drawings and estimates
for the works intended
by Mr. Robertson nearly
to double the depth of
water over Cochin Bar.
The Government are
unable just now to
carry out Col: Walker's

suggestion of instituting
a Cochin and West Coast
Canal Range, but order
the following arrange-
ments to be made, as
the best means avail-
able for strengthening
the hands of the Palghaut
and Mangalore Range
Officers. Viz: the transfer
of Supervisor Vyapoory Pillay
now under orders for Coon-
dapoor Range to the
Palghaut Range, of which
he can take charge
freeing Asst. Engineer
Grime for the Cochin
Work. And the promotion
of Overseer De Mello to
rank of Supervisor vice

Cowley dismissed, and his posting to the Conda-poor Range now held by Apt. Engr. Pringle in addition to his own.

Of the Minor Works of improvement suggested by Mr. Robertson for Cannanore and Beypore, the Subp: Engineer of the 7th Dist. will be good enough to submit Plans and estimates.

The attention of the Master Attendant at Madras (Administrative Dept.) is called to the requirements of the Port of Calicut, to which

13

he will be so good as to attend; reporting when they shall have been met.

The subject of Inland Water Communication along the West Coast will be disposed of separately at a later date in connection with a scheme now before Government involving its development by private enterprize.

Looking at the character of the bay into which the Paumben Passage opens as well as the tortuous nature of the channel, Mr. Robertson reports that it would be out of all question to attempt to make the

Pass fit for large ships; or indeed deeper than 12 feet at low water of Spring tides. The attention of the Supg. Engineer of the 8th Divn. is called to Mr. Robertson's Remark that the season was being lost for blasting operations for want of a regular supply of powder. and Mr. Dalrymple is requested to report on the character and cost of the lights stated to be required at Point Calimere and the Crocodile Rock.

The remarks in page 53 on one if not two safe and commodious anchorages close to the locality of the new

5 15

What does
this mean?

R.?

Ship Canal between India and Ceylon, ~~improved~~ proposed by Sir James Elphinstone, are full of interest.

The Supg. Engineer of the 6 Division will have plans and estimates prepared for lengthening the Pier at Negapatam 150 feet beyond Monsoon low water line, for deepening and fixing the ~~north~~ south side of the outlet, and for dredging the harbour, as recommended at pages 55 and 56 of Mr. Robertson's report. It is observed that he approves generally of the report of the Committee of 1860.

The Government have

had frequent remonstrances addressed to them on their neglect of Cocanada which is acquiring considerable importance as a place of trade. Mr. Robertson's report is discouraging but it is useful as furnishing a reply to the frequent Memorials addressed to Govt. and as preventing waste of money on the various projects which have been submitted. Copy of this part of his report will therefore be communicated to the Memorialists.

The Master Attendant of Madras will carry into effect Mr.

~~Robertson's recommenda-
tions that the whole length
of channel from Cocanada
to the entrance of Coringa
River should be buoyed off;
and he will report on the
cost of the dredging opera-
tions to be undertaken
at Coringa and Cocanada
Bays, of a light boat off
Hope Island, and of the
cost (with maintenance)
of a steam tug for the
Master Attendant at Co-
canada. It is understood
to be his intention shortly
to proceed to the Northern
Ports and these points
should specially engage
his attention there.~~
The Supg. Engineer of the

I doubt the ex-
-pediency of sending
the Master Attendant
to Coconada. He &
Mr Fisher are
certain to come into
disagreeable collision.
I would not encourage
the Master Attendant
in making tours. He

~~1st Division will co-operate~~ report as
~~to the Agency necessary~~
~~with Mr. Dalrymple in~~
~~every way on learning~~
~~from him of the proposed~~
~~preinstructing~~ date of his visit. The proposed survey of the neighbourhood of Hope Island and Experiments as to currents; ~~Should have their attention, and be reported on as to details of the Agency required to carry them out and probable cost~~ and the Cocanada Harbour Works suggested in page 73 will also be planned and estimated for.

The subject of a Breakwater at Madras on which the Chief Engineer

---

can be more usefully employed in his office at Madras

[signature]

I agree. It will be better to omit this passage

[initials]

has reported against the delay considered expedient by Mr. Robertson has been ~~reported on to the Govt. of~~ ~~disposed of separately~~ in office. –

It is observed that Mr. Robertson makes no recommendations for works at Aleppy, Narakal, Quilon, Tuticorin and Porto Novo, either because none are practicable, or, if practicable, advisable, on account of disproportionate expense.

G.M.W.

150
74

34 To Supg. Engrs., 1st, 4th, 5th, 7th & 8th Divns.
" Marine Dept.
9 Controller.
" Master attendant (administrative Dept.)
3 " Chamber of Commerce, Madras.
" 3 Do. Cocanada, with Extract.

Desp. 10/6/72 – with as many copies of the memo: as the office order according to ranges –

has reported against the dredging considered expedient by Mr. Robertson ~~has been adopted on the Coast of Malabar~~ [illegible] Coast.

It is observed that Mr. Robertson makes no recommendations for works at Alleppy, Porakad, Quilon, Tuticorin and Pahlo Caro, either because none are practicable, or, if practicable, advisable, on account of disproportionate expense.

[illegible]

Marine Dept.

Collector.

Chamber of Commerce, Madras.

Do. Coconada, with extract [illegible]

had

[illegible] on to the East of

[illegible]

[illegible] dead.

(5)

Draft order of

Circular to Nagpur [illegible]

[illegible]

Print this order [illegible] by [illegible]

23

Memorandum by the Chief Engineer

Mangalore Harbour.

It is a satisfaction to me to find that Mr. Robertson coincides in the opinion which I formed and expressed many years ago as to the necessity of closing the Gaorpoor Gap and I quite concur in his advice that the gap should be directly acted on by damming its mouth, instead of indirectly as in 1856 by damming the River and so restricting

The [illegible] have [illegible] [illegible] & I [illegible] at last [illegible]

J. D. S.

Yr. [illegible] on Lord [illegible] will [illegible] to [illegible] it may be well to [illegible] the [illegible] of my orders until he has [illegible] to with the proposal [illegible]

A. R.T.E.

the tidal basin that the gap must have closed of itself. I have to point out however that the destruction of the dam of 1856 was not caused by any action of tide, but by a river fresh which came down on the night of the 30th April, the commencement of the work having been delayed too late for want of early sanction.

I do not agree with Mr. Robertson in one point; for I do consider it desirable to close the gap at once. Nothing could be

I think the economy advised in this Mem^o. sh^d. be adopted.

As regards the proposal for the construction of a Breakwater at Madras, I think the time has come when the case should be brought before the Gov^t. of India, with a view to the provision of the necessary funds, as part of the charge for "Public Works Extraordinary". The Report of the Committee and of Mr. Robertson, with full details as to the nature of the work, and its estimated cost, would of course be laid before them.

JW

better than his modus operandi, whether for the closing of the gap itself by a sand bag dam or for gradual action on the shoals between it and the harbour mouth by a training groyne of slight material. I would commence with the second certainly, as he recommends, but when the scouring action which must inevitably ensue has gone on for a sufficient time I would proceed to the execution of the dam. It will be much easier to clear out the shoal between the two river mouths now than in 1858 as comparison of the two surveys will show that its length

is reduced since that date by fully 1000 yards and the soundings show a great improvement also and the danger of flooding above is proportionally decreased.

Reliable estimates cannot be made of the probable cost of this work till after the monsoon when the River floods are over and the gap has settled down to its dry weather form. I would place the sum of Rs: 7000 transferred from the Mangalore Pier at the Supg: Engineer's disposal for Collection of materials during the Monsoon to the value of Rs: 5000, viz:

sandbags, piles, bundles, and brushwood &c., and by September the Executive Engineer might commence the training groyne under instructions from Lieut. Col. Farewell, who has lately been watching the progress and results of a similar work at Cochin, and will be able to tell him precisely how to act. By November, estimates for closing the gap may have been sent in and sanctioned, when I should hope that the Supg. Engineer would be able to find time to visit Mangalore and have the work carried out under his own eye.

Lieut. Col. Farewell will then also be able to prepare detailed estimates of the cost of carrying out Mr. Robertson's suggestions for fixing the north of the Harbour Mouth, when the propriety of acting on them may be considered. For my part I do not think any thing of the kind should be done. I believe that so long as there are two outlets to the sea from the backwater which joins the Naitravutty and Goorpoor Rivers and Tidal Basin, so long with the outlet of the Southern and much ~~larger~~ larger

13
29

River tend gradually northward either till it meets the northern gap (which is quite stationary); or, which I consider most probable and highly desirable, till a greater than usual Monsoon flood bursts out a passage for itself near Oolant where the mouth was at the commencement of the century, when there is reason to believe that the Harbour Bar was much better than it has been ever since. Indeed, it is well known to have deteriorated the further north the outlet was.

Hence the primary necessity for closing the Goorpoor gap, when three

natural forces, viz. the respective river streams acting from within, and the tide water from without, will by a natural dynamical law, fix the single outlet in a position which will will be the natural resultant of the three forces; and to be preferred to any artificial outlet against which one or other of them would be working detrimentally. Not but that there might possibly be a certain amount of shifting of the natural outlet according to the varying

31 14

Cochin Harbour

monsoon floods of the rivers, but works to control that fluctuation would be much less costly to construct and maintain than those which would be required to keep in its place an outlet not the resultant of natural forces.

It does not appear practicable to spare Mr. Pringle the services of an Assistant as proposed by Mr. Robertson, but arrangements have been made for relieving him of the Coondapur Range; which Lieut. Col. Farewell once thought of doubling up with the Mangalore Range an idea which he has now abandoned much to my satisfaction and the work of Mangalore Range will not be so heavy this year as to prevent Mr. Pringle devoting

much of his time to Harbour Observations and work.

All Mr. Robertson's suggestions as to the closing of the Cruz Milagre Gap, and defence of the Cochin and Vypeen Coasts have already been acted upon by Lieut Col. Farewell, to an extent of which he has reported the success and probable cost of work in continuation, and G. O. No. 1125 of 2d May 1872, which embodies my views will show how thoroughly I approve of all that Mr. Robertson has recommended on the subject - That of

Cochin Harbour.

increasing the depth of water
over the Bar is one with which
I have not hitherto had to
deal at Cochin, my attention
having been confined to
protective works. I have
perused Mr. Robertson's re-
marks on the treatment
of the bar with great interest,
and though hardly prepared
to endorse his sanguine
anticipation that by the
construction of training
groynes of from 2 to 3000
feet in length and by
dredging, the present depth
of 11 feet over the bar
may be increased to 20
or 21 feet, I cannot in
the least gainsay the
general accuracy of his
conclusion that

"to strengthen the current
"and confine it till it
"arrives into deeper water,
"where the waves act
"with less effect on the
"bottom is evidently the
"way to treat the harbour
"at Cochin."

I propose accordingly
to call on the Supdg. Engi-
neer to prepare detailed
Drawings and Estimates of
two groynes composed of
rubble cores faced with
concrete blocks, as I con-
ceive that the use of
both materials would
lead to speed and economy
of construction. Special
assistance must be af-
forded him as well as
funds for supervision

of works already in hand, surveys and measurements of those to be undertaken, and preliminary investigation as to the cost of quarrying and moving Rubble on a large scale, and of making Concrete blocks say of 8 Cubic yards (9ft. × 4½ × 4½) or half the dimensions of those used at Kurrachee. The same Officer would hereafter be available for investigating the details of the improvements to Canal communication along the West Coast on which Mr. Robertson makes remarks of great practical interest. In fact I would create at once a Cochin and West Coast Canal Range

and provide for its cost by savings which I have no doubt the Controller will be able to indicate.

I am not of opinion that the erection of a ~~___~~ bund across the backwater at Palliport is necessary or even desirable. It would hamper existing traffic and tend to accumulation of deposits, troublesome and costly to remove; and the tidal basin of Cochin is already so enormous that the proposed extension would not by its additional action benefit the bar to an appreciable extent.

Madras Breakwater.

17

31

Mr Robertson has decided that a Breakwater is the best expedient for obtaining shelter for shipping at Madras, but takes advantage of some loose reasoning of the Harbour Committee (with which he evidently does not himself agree) to demand further information as to the littoral currents, and quantity of sand in motion along the coast. I think that he has put aside the information already supplied, without due cause; and that, had he argued upon it with the same ~~perspicuity~~ cacity with which he computed the notion of sand accumulating round piles of stone on the Armagham

Shoal (see page 68) he would not have come to the conclusion that there was any danger of silting up behind the backwater.

In point of fact he only comes to such conclusion on a false hypothesis of the Committee, not concurred in by himself, and opposed to the true conclusion to be arrived at from existing information as to currents and sand. This is to the effect, on the one hand, that at from 600 to 1800 yards from the shore there are littoral surface currents, not exceeding one mile an hour in maximum velocity, and on the other

that there is no current at bed of sea at 7 fathoms, (beyond which it is proposed to construct the Breakwater), and no loose moveable sand beyond the 6 fathom line. There is no reason whatever to doubt the accuracy of these observations; and it only remains to draw correct conclusions from them.

As Mr. Robertson says, there are two agents at work to move the sand, the surf acting perpendicularly to the shore and the littoral currents parallel to it; the former agitating the sand, and causing it to be held in suspension, the latter moving it north

or South according to the season. But there is not the slightest ground for imagining that the littoral currents beyond the 6 fathom line are at all impregnated with sand; it is all dropped within that line. Hence there can be none to deposit beyond 7 fathoms where the Breakwater is to be. Hence also the fallacy of the Committee's reasoning against Mr. Fraser's project; their objection would be invalid against Groynes reaching out beyond 6 fathom water. Mr. Robertson has hit the true objection to his scheme which is otherwise the

4 / 14

best proposed after the
Breakwater project.

I deprecate therefore
any postponement of the
Breakwater scheme on the
score of further information
being necessary as to cur-
rents and sand deposits.
It is now matured suffi-
ciently to be determined
for or against on the sim-
ple grounds of its value
compared to its cost. The
Master Attendant could
easily procure further in-
formation as to currents,
if necessary. As to the ex-
tent to which sand is
moved, nothing but
actual construction of a
groyne out beyond six
fathom line would settle

the question experimentally.
But I maintain that for all practical purposes we have information enough. it has only to be argued upon as correctly as has been done by Mr Robertson in the matter of a proposed Breakwater on the Armaghum Shoal. The argument in page 61 of the Report that the removal of one motive agent, the surf, would cause the other agent to drop sand behind the Breakwater is fallacious, because it assumes that the littoral current will have sand in suspension. Whereas it can have none outside 6

48

fathom line, in any case; still less behind the breakwater, where the agent which agitates the sand and makes it moveable, will be annihilated. Hence the Committee had reason to conclude on the one hand that the foreshore will be rendered steeper, but none on the other hand, for apprehending its extension; as the littoral current freed from action of surf should tend to keep the foreshore clean swept of loose sand.

G.W.W.
8.5.72

Govt. of {1872} Madras.

PUBLIC WORKS.

To The Superintending Engrs. 1st 4th 5th 6th 7th and 8th Divisions

Dated

Recd. Encl.

G. O. 12th June 1872, No. 1449.

Order

Nos. 184

Harbours of the Madras Presidency. Passing orders on Mr. Robertson's report

MADRAS RECORD OFFICE.

Government Records.

Public Works. Department.

G. O. (Printed).

Dated 12-6- 1872.

No. 1449

Back No. 184